Human Capital, Innovation, and Productivity in Vietnam's SMEs
- Evidence from the Manufacturing Industry -

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Abstract

Considering the crucial role of innovation and entrepreneurship in the development of small and medium enterprises (SMEs) in the Vietnamese economy, the study examines the impact of entrepreneurial human capital on innovation (improvement of an existing product/service or introduction of a new product/service) and productivity (total factor productivity) in SMEs. The analysis is based on primary data obtained from a questionnaire survey of manufacturing SMEs in Hanoi in 2014 and several interview surveys in various industrial cities in Vietnam. The questionnaire survey includes 600 enterprises and covers 17 subsectors of the manufacturing industry. The analysis reveals that (1) entrepreneur's education at the college or higher level stimulates innovation, while backward technology applied in the firm appears to be hindrance to innovation ability; (2) firm experience, represented by the age of a firm, is associated with higher innovation probability, but does not significantly enhance firm productivity; and (3) types of firm and industrial sectors reveal mixed results in terms of innovative activities and successful entrepreneurship. The findings emphasize the importance of human capital in promoting innovation and fostering productivity enhancement at the firm-level, and pertain to the human resource development and entrepreneurial human capital in enterprise development.

Keywords: *human capital; innovation, TFP, SMEs; Vietnam*
JEL Classification: *D24, J24, O31*

1. Introduction

It is widely recognized that the private sector plays a crucial role in fostering a country's competitive advantage. Vibrant private enterprises, in large number, offer job opportunities and income to the labor force, and produce goods and services for people to have a greater choice in consumption. In developing countries they contribute to poverty reduction, industrialization and economic development as well. In Vietnam it was not very long ago that the private sector with small and medium enterprises (SMEs) as the backbone began to emerge and contribute to the socioeconomic development process, and that its role has been recognized.

Among the major economic sectors contributing to the country's output the manufacturing industries have emerged as the leading sector, followed by the agricultural, trade, mining, construction and financial sectors. According to the Key Indicators of the Asian Development Bank, the share of the manufacturing sector in gross domestic product (GDP) has steadily increased in the last two decades from 15% in 1994 to 20% in 2014. It surpassed the agricultural sector in 2011 and has since been the spearhead sector in output. In terms of job creation the manufacturing sector is second only to the agriculture and its share in total employment has risen from 8% to 18% over the same period (Key Indicators, various issues). The dominant role of SMEs in supporting the industrialization process and generating employment opportunities among the non-agricultural sectors has drawn attention in the academic and policy making circles in Vietnam.

Schumpeter (1934) was among the pioneer economists to discuss the role of innovation (he often used the term 'new combination (*neue Kombination*)') in economic development. Innovation is essential for firms – even more so in the current globalized environment – which intend to develop and maintain a competitive advantage or to develop new market (Ho and Pham, 2014; Becheikh et al., 2006; OEDC, 2005). The degree of importance of innovation to competitive advantage is even higher in SMEs than in larger enterprises. The contribution of SMEs to economic growth is greatly channeled through their innovativeness (Radas and Božić, 2009). There exists a view on the role of innovation at the macro- and micro-levels in the economy. In the former, innovation is deemed to contribute to the nation's industrial and economic growth, while in the latter it enhances competitive advantage and potential growth of firms (Pham and Matsunaga, 2016).

In the global context Vietnam has experienced an encouraging trend in innovativeness. In the Global Competitiveness Report 2015-2016 – the most recent edition – of the World Economic Forum, Vietnam has moved up the Global Competitiveness Index Rankings (GCIR) from the 68th in 2014-2015

to 58th out of 140 economies covered in 2015-2016. Yet, the country still ranks far behind the ASEAN5[1] countries, namely Singapore (GCIR=2nd), Malaysia (18th), Thailand (32th), Indonesia (37th), and the Philippines (47th). Her ranking is only above the new ASEAN member countries like Laos (83th), Cambodia (90th), and Myanmar (131th).

Despite its importance in enterprise and economic development, the topic of innovation has so far received little attention and been marginal in the literature on SMEs in Vietnam. In the previous wave of literature innovation was found to be crucial for survival in the 1990s, the earlier phase of the Doi Moi (Hansen et al., 2006). More recently, innovation has been addressed in relation to trade and found to encourage exports of SMEs (Nguyen et al., 2008). At the micro-level, innovation is an important factor for superior performance of household enterprises in an iron and steel industrial cluster, while human capital (measured by formal schooling and experience) and social capital are among the underlying factors of innovation (Vu et al., 2009; Vu et al., 2010). The impact of entrepreneur's human capital on innovation in Vietnam's manufacturing industry has received increasing interest in recent literature. Vu (2014) and Pham and Matsunaga (forthcoming) find that entrepreneur's formal education and practical experience significantly enhance innovativeness of micro enterprises and SMEs.

Nonetheless, these are merely a few published studies on innovation, whereas there is a pressing need for more rigorous studies on innovation and human capital in Vietnam's SMEs. The current study attempts to fill this research gap and looks into the relation between entrepreneurial human capital and innovation for Hanoi, the capital city of Vietnam. The study applies primary data from a survey of SMEs in Hanoi in 2014 to examine how entrepreneur's education, experience prior to startup and other personal skills influence innovation outcome of SMEs.

In literature the measurement and treatment of innovation differs greatly across academic disciplines and among the scholars. Since the introduction of the concept of 'innovation' in Schumpeter's era the scope of 'innovation' has changed noticeably. In Becheikh et al. (2006) innovation is defined as 'implemented technologically new products and processes and significant technological improvements in products and processes'. In their respect (technical) innovation implies a technologically new product/process or an existing product/process that has undergone a significant technological improvement.

In literature studies on innovation can be classified in two broad categories. First, the measure of innovation is treated as a dependent variable in a model and explained by a set of factors that are considered to influence its change (Bhattacharya and Bloch, 2004; Laursen and Salter, 2006; Fabrizio and

[1] ASEAN5 refers to five members of the Association of the South East Asian Nations: Indonesia, Malaysia, the Philippines, Thailand and Singapore.

Thomas, 2012; Garriga et al., 2103; Klingebiel and Rammer, 2014). Second, innovation is treated as an underlying determinant of a quality, such as firm performance or productivity (Terziovski, 2010). In the former category several factors, such as internal and contextual factors, have been addressed in economics and management literature: firm size (Bhattacharya and Bloch, 2004; Klingebiel and Rammer, 2014), demand structure (Fabrizio and Thomas, 2012), resource allocation and breadth (Klingebiel and Rammer, 2014). The current study belongs to the first category, as it tries to explore how entrepreneurial human capital would affect the innovative activities of the firm. The analysis applies primary data from a questionnaire survey of about 600 hundred manufacturing small and medium enterprises in Hanoi in 2014 (hereafter: SME Survey-2014) and results of several interview surveys in three industrial centers in Vietnam (Hanoi, Danang, and Ho Chi Minh City). The SME Survey-2014 includes 17 subsectors of the manufacturing.

The remaining of the paper is laid out as follows. Section 2 presents some recent trends of SMEs and their innovative activities. The empirical model and data are described in Section 3. Analysis results are presented and discussed in Section 4. Section 5 concludes and outlines some policy implications.

2. Vietnam's SMEs and Their Innovative Activities[2]

Small and medium enterprises are defined in the Decree No. 56/2009/ND-CP, which classifies enterprises into micro, small and medium enterprises for three economic sectors (agriculture, forestry and fishery, industry and construction, and trade and service). The classification is based on the number of employees per year and value of total capital. In the decree, a micro enterprise in agriculture and manufacturing shall have up to 10 employees, a small enterprise 11 - 200 employees and/or up to VND 20 billion, and a medium enterprise 201-300 employees and/or VND 20 - VND 100 billion (Table 1).

In terms of location and economic activity, SMEs are quite flexible because they can adjust their product lines in relatively short time in response to changes in market conditions. They can also support regional and rural development, as they can be located in more rural areas as compared to large enterprises (LSEs). The non-state sector is characterized by the dominance of SMEs. The statistics in Table 2 confirm the dominance of micro, small and medium enterprises (MSMEs) in the Vietnamese economy. In particular, during the period of 2000-2011 the total number of firms in Vietnam has increased steadily from 42,288 to 324,691, of which micro, small and medium enterprises comprise between 92% and 98%.

[2] Information for this section is drawn from our field surveys in Hanoi and Ho Chi Minh City in 2012, 2014, and 2016 (August).

Table 1: Definition of small and medium enterprises in Vietnam

Sector	Micro enterprises	Small-size enterprises		Medium-sized enterprises	
	Number of laborers	*Total capital*	*Number of laborers*	*Total capital*	*Number of laborers*
I. Agriculture, forestry and fishery	10 Persons or fewer	VND 20 billion or less	Between over 10 persons and 200 persons	Between VND 20 billion and VND 100 billion	Between over 200 persons and 300 persons
II. Industry and construction	10 Persons or fewer	VND 20 billion or less	Between over 10 persons and 200 persons	Between VND 20 billion and VND 100 billion	Between over 200 persons and 300 persons
III. Trade and service	10 Persons or fewer	VND 10 billion or less	Between over 10 persons and 50 persons	Between VND 10 billion and VND 50 billion	Between over 50 persons and 100 persons

Source: Decree No. 56/2009/ND-CP (Government of Vietnam, 2009)

The statistics of Hanoi confirm the similar trend of SME-dominance in the national economy. In Hanoi MSMEs comprise 93% - 99% of all enterprises in the decade of 2000-2011. During this period the number of enterprises in Hanoi increases steadily from 4,691 to 72,455 firms, of which the number of MSMEs rises from 4,340 to 71,622 firms. On average SMEs grow at the rate of 30% over the same period (slightly higher than that of total classification of 29%), of which enterprises with fewer than 5 employees growing at the rate of 58%, followed by firms with 5 to 9 employees with 34% (Table 3).

In order to understand the perception of entrepreneurs on 'innovation' and their innovative activities, we conducted an interview survey of MSMEs in the manufacturing industries in Hanoi and Ho Chi Minh City (HCMC) in August 2016. We visited eight enterprises in Hanoi and 13 enterprises in HCMC, and conducted comprehensive interviews with owners and/or managers. The MSMEs covered in our survey belong to the following subindustries: machinery (production of simple machines), garment (production of towels, bags), steel work (workshops producing steel gates, household equipment, for example extraction fans, steel boxes for power stations, making spare parts, etc.), embroidery (embroidery art, painting-like picture, etc.), wood processing (production of furniture, decoration items, etc.), plastics work (nylon net for safety use in construction, sprayers for agricultural production), high-end toys (fiber-carbon helicopters and spare parts), mold production (mold for large size printing or package printing), steel manufacturing (water taps, bathroom equipment, etc.), and precision technology (production of industrial machines, electrical equipment, etc.).

Table 2: Number of enterprises by size in Vietnam, 2000 - 2011 (# of enterprises, %-share)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total number	42,288	51,680	62,908	72,012	91,756	112,950	125,092	149,069	192,179	236,584	279,360	324,691
Micro (%)	53.53	54.10	52.53	51.31	53.45	56.18	61.00	61.22	62.52	66.24	67.15	66.75
Small (%)	34.04	34.93	37.08	38.97	38.20	36.60	32.36	32.49	32.19	29.07	28.31	28.75
Medium (%)	4.37	3.81	3.63	3.45	3.15	2.83	2.63	2.64	2.27	2.06	2.01	2.11
***SMEs* (%)**	***91.9***	***92.8***	***93.2***	***93.7***	***94.8***	***95.6***	***96.0***	***96.4***	***97.0***	***97.4***	***97.5***	***97.6***
Large (%)	8.05	7.16	6.75	6.27	5.20	4.39	4.01	3.65	3.02	2.63	2.53	2.39

Source: General Statistics Office of Vietnam (2005-2012)

Note: 1. The classification of enterprises into small, medium and large size categories is based on the Decree No. 56/2009/ND-CP (30 June 2009).

2. Statistics are of 31 December of the respective years.

With respect to the characteristics of the MSMEs covered under the interview survey, they belong to low-tech to relatively advanced technology subindustries, from informal/household to industrial sector, from a few workers (family labor) to more than 100 employees. The smaller enterprises mainly produce goods based on customers' orders (e.g. household equipment, simple pressing machines). Some medium sized enterprises develop their own product series (e.g. embroidery art, agricultural sprayers, water taps, electric motors, etc.), or produce high-tech machines and equipment based on orders (e.g. remote-controlled helicopters). Some enterprises export their products to neighboring countries, such as Laos and Myanmar, or even to the developed markets (high-end toy helicopters).

Table 3: Trends of micro, small and medium enterprises in Hanoi (# of enterprises, %-share)

Enterprises	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total number	4,691	6,407	9,460	11,813	15,068	18,214	21,448	24,557	38,248	47,137	58,639	72,455
MSMEs	4,340	6,028	9,023	11,334	14,548	17,696	20,929	24,019	37,621	46,473	57,894	71,622
MSMEs (%)	***92.5***	***94.1***	***95.4***	***95.9***	***96.5***	***97.2***	***97.6***	***97.8***	***98.4***	***98.6***	***98.7***	***98.9***
< 5 persons	9.4	12.1	14.4	14.5	16.3	16.8	4.8	14.6	14.8	16.2	20.7	27.4
5-9 persons	28.5	30.2	32.1	33.1	33.2	35.2	57.6	41.9	42.0	43.1	45.8	34.5
10-49 persons	36.6	37.7	36.9	37.3	37.7	36.7	27.4	33.6	35.0	33.4	27.0	30.6
50-199 persons	14.6	12.0	10.0	9.3	8.2	7.5	6.8	6.8	5.8	5.2	4.5	5.7
200-299 persons	3.4	2.2	2.0	1.7	1.2	1.0	1.0	0.9	0.8	0.7	0.6	0.7

Source: The enterprises in Vietnam 9 years at the beginning of century XXI, General Statistics Office of Vietnam, Statistical Publishing House, Hanoi, 2010. Development of Vietnam's enterprises in the period 2006-2011, General Statistics Office of Vietnam, Statistical Publishing House, Hanoi, 2013.

Note: 1. Figures in the table represent the percentage share in the total, except for the first two rows.

2. Statistics are of 31 December of the respective years.

In terms of innovation, the results of the interviews and discussions can be summarize as follows: (1) The MSME owners understand that modifying the styles of their products to meet customers' demand or orders is an innovation; (2) Modifying the outlook of the product (decoration) or imitation of existing products on the market is an innovation; (3) Using several products available on the market to design her own product (embroidery art) is understood as an innovative activity; (4) Most of the modified or

improved products are new only to the enterprise, but not new to the market, industry or country; (5) New products are understood as new items that are added to a product series with some minimum change in the feature or shape, but they do not contain any significantly improved characteristic; (6) Investing in new and more advanced machinery for improving production is regarded as innovation; and (7) Some enterprises design their products and launch new products, or they improve some features of the existing products based on the comments received from consumers via their retailers. But the last case is a rare occasion.

In sum, innovation among MSMEs in Vietnam is understood as 'modification of a product,' 'adaptation of a product to the need of customers,' 'improvement of certain features of a product.' Therefore, it is necessary to bear in mind that the notion of 'innovation' or 'innovative activity' in this study is applied based on the understanding or perception of local entrepreneurs as described above. Although the understanding on *'innovation'* among local entrepreneurs differs significantly from the initial meaning of the concept, this notion of innovation is deemed reasonable for a developing country like Vietnam, where MSMEs still lack the necessary innovative capabilities to develop products or processes that are truly new to the market, country, or world. Their daily operations concentrate on survival in the competition and remaining in the business as long as possible.

3. Analytical Framework and the Questionnaire Survey in Hanoi

3.1 Human capital and Innovation

Human and social capital is considered to have some influence on firm's innovation (strategies, activities, investment, output, etc.) and firm's performance (sales, profitability, efficiency, productivity, etc.). This study examines the influence of entrepreneur's human capital on innovation (output) and performance (productivity). There are several definitions of human capital used in economic literature. One definition, which is introduced in Rooks et al. (2011) and considered suitable for this study, states: "*... the knowledge and skills that economic actors have acquired, which can be employed for productive purposes, thereby generating income.*" In this respect, human capital, which is widely considered as personal knowledge, skills, and experience, can improve entrepreneur's capacity in performing her managerial tasks, recognizing and exploiting business opportunities, accessing various resources, and facilitating the acquisition of new knowledge and skills. In empirical studies human capital is widely represented or measured by level of education (Asuyama et al., 2013; Santarelli and Tran, 2013) and experience and/or sector-specific experience (Bosma et al., 2004; Vixathep, 2013).

However, the entrepreneur does not appear as an explicit agent in most production functions, rather her ability is evaluated by means of the performance of enterprise she manages and/or owns. Performance indicators applied in empirical literature include, but not limited to, output, sales, employment, efficiency, productivity (TFP), labor productivity, survival, profitability, etc. Human capital is found to enhance the performance of both firm owners (Pennings et al., 1998; Van Praag et al., 2013; Vixathep, 2013) and workers (Mincer, 1974). Investment in industry-specific human capital (social capital as well) of founders of small businesses – such as experience in a specific industry – contributes to an increase in employment and enhances enterprise performance (profit, survival), while endowment of talent is not the underlying factor of such performance (Bosma et al., 2004). In this study, human capital is represented by education (level of education), job experience and some personal skills of owners.

Innovation is a complex and continuous process. Firms continuously accumulate new knowledge and constantly modify their products and processes to adjust to changing business conditions. Innovation is also considered as a tool of entrepreneurs to exploit change as an opportunity for a new or a different business and service (Drucker, 1985; OECD, 2005). Innovation is evaluated in various ways. On the one hand, the input-oriented measurement of innovation uses data on R&D (research and development). But R&D expenditure tends to overestimate innovation, because it includes aborted efforts that do not necessarily lead to new or significantly improved products/processes. On the other hand, the output-oriented measurement applies patent data, innovation count and firm-based surveys. However, a patent would better represent an invention rather than innovation. The method of innovation count is deemed an objective approach which relies on innovation data from various sources, such new product/process announcements, database, journals, etc. (Becheikh et al., 2006).

In empirical studies innovation is commonly represented by number of innovation (Acs and Audretsch, 1988; Fabrizio and Thomas, 2012), number of patents (Lahiri and Narayanan, 2013), binary variable indicating introduction of a new product/service/process or improved product/service/process (Bhattacharya and Bloch, 2004; Spithoven et al., 2013), or revenue from new products (radical innovation) and revenue from significantly improved product (incremental innovation) (Laursen and Salter, 2006; Garriga at al., 2103; Klingebiel and Rammer, 2014; Love et al., 2014; Ozer and Zhang, 2015). For the analysis in this study a question was asked whether or not the owner has had a product/service improvement or introduced a new product/service in the last two years. Hence, a dummy variable, which represents successful innovation and indicates the introduction of a new production/process or an improved product/process, is used as an explained variable in the empirical analysis.

3.2 Empirical model

In empirical literature entrepreneurs are often considered as those who have established a business or acquired an existing business and decided to take all the risks associated with the businesses, or who are self-employed in a business. They are considered as factory/business owners or managers (Van Praag, 1999; Van Praag and Cramer, 2001; Naude, 2013). Entrepreneurial success is assessed by several indicators, such as the period of business survival or the number of personnel under her control (Van Praag, 1999), survival, profit and employment (Bosma et al., 2004; Santarelli and Tran, 2013), job creation (Audretsch, 2003). In this study, entrepreneur's human capital is considered to exert some impact on innovation output (Terziovski, 2010) and total factor productivity (Asuyama et al., 2013; Vixathep, 2013). The empirical analysis applies a methodology for evaluating determinants of productivity using firm-level data in a production function introduced in Dollar et al. (2005) and Van Praag and Stel (2013).

The productivity equation in Dollar et al. (2005) is expressed as

$$TFP_{it} = \boldsymbol{\delta}'\boldsymbol{X}_{it} + \omega_{it} + \varepsilon_{it} \quad (1)$$

where $\boldsymbol{X}$ is the vector of observable investment climate indicators (available data), the index i denotes the *i-th* firm, t denotes the time period, ω and ε are an unobservable productivity shocks that do, and do not affect firm's input choice, respectively.

With some modifications the above model can be applied for evaluating the impact of entrepreneur's human capital on innovation and total factor productivity:

$$innovation = \alpha_0 + \boldsymbol{\delta}_j\boldsymbol{H}_{ij} + \boldsymbol{\gamma}_j\boldsymbol{X}_{ij} + \varepsilon_i \quad (2)$$

$$lntfp = \alpha_0 + \boldsymbol{\delta}_j\boldsymbol{H}_{ij} + \boldsymbol{\gamma}_j\boldsymbol{X}_{ij} + \varepsilon_i \quad (3)$$

where $\boldsymbol{H}_{ij}$ denotes a vector of entrepreneur's human capital variables (education levels, experience, and firm's technology level)) and other characteristics (age, gender), $\boldsymbol{X}_{ij}$ is a vector of explanatory variables that describe the enterprise (firm age, types of enterprise) and economic sectors or manufacturing subsectors, j is the number of independent variables in the models, and ε_i denotes the statistical error term. Dependent variables include the innovation dummy variable ($innovation$) and total factor productivity ($lntfp$). The estimation of impact of entrepreneur's human capital on '*innovation'* applies a Probit model (Equation 2), and the estimation of the productivity model uses the Ordinary Least Squared (OLS) procedure (Equation 3).

Total factor productivity (TFP) is estimated using the Solow residual method which assumes a Cobb-Douglas type production function with labor and capital (due to lack of information on intermediate goods or material input):

$$Y_i = AK_i^{\beta_K} L_i^{\beta_L} \quad (4)$$

$$\ln Y_i = \ln A + \beta_K \ln K_i + \beta_L \ln L_i \quad (5)$$

$$lntfp = \ln A = \ln Y_i - \beta_K \ln K_i - \beta_L \ln L_i \quad (6)$$

The coefficients of the capital and labor share, β_K and β_L, are obtained from the estimation of Equation (5). Labor and capital are assumed to contribute to output in a constant-return-to-scale technology. Given the data from the Survey, Equation (6) could be specified as follows:

$$lntfp = \ln(sales2013_i) - 0.659 \times \ln(cap2013_i) - 0.301 \times \ln(labor2013_i) \quad (7)$$

3.3 The questionnaire survey, data and variables

A questionnaire survey on micro, small and medium enterprises was conducted in Hanoi/Vietnam from May to July 2014. The target group is owners or managers of SMEs in the manufacturing industries. The sampling method is a stratified random sampling. The survey covers some industrial clusters or production centers in Hanoi City. The survey is conducted in cooperation with the General Statistics Office of Vietnam (GSO), the Ministry of Planning and Investment (MPI). GSO has the list of registered firms in Hanoi, which is used as the population for the survey. Within an industrial cluster, firms with up to 300 employees (i.e. SMEs) are selected with equal probability using a stratified random sampling procedure. Also, a balance between the industrial subsectors and clusters/locations is taken into consideration. The samples would well represent the manufacturing industry of Hanoi in terms of industrial subsectors and locations/areas.

Table 4: Definition of variables from the survey

Variable	Definition/Description
Production inputs and output, and innovation	
sales2013	Total sales in 2013 in million VND (Vietnamese Dong, local currency)
cap2013	Value of capital equipment in 2013 in million VND
currlabor	Current number of workers in 2013 (persons)
innovation (product innovation)	Dummy variable for innovation, and equals 1 if true (innovation is defined as introduction of a new product/service and/or significant improvement of existing product/service between 2012-2013)
lntfp	Total factor productivity, estimated from the production function using the Solow Residual method
Characteristics of entrepreneur	
ownerage	Age of entrepreneurs (years)
maleowner	Dummy variable for male owner, and equals 1 if true
gradedu	Dummy variable for Master's and doctoral education, and equals 1 if true
collegeuniv	Dummy variable for college-/university-level education, and equals 1 if true
*vocatedu**	Dummy variable for vocational education, and equals 1 if true
Otheredu	Dummy variable for other type of education, including no education; not completed primary education; lower and upper secondary education, and equals 1 if true
*soeworker**	Dummy variable for having worked in a state-owned enterprise (SOE) prior to start-up, and equals 1 if true
nonsoeworker	Dummy variable for having worked in a non-state enterprise prior to start-up, and equals 1 if true
trader	Dummy variable for being trader prior to start-up, and equals 1 if true
famothexp	Dummy variable for having worked for family business or having other experience (worked in government sector, farmer, unemployed, too young to work, etc.), and equals 1 if true
primtec	Dummy variable for enterprise using hand tools or manually operated equipment for the business, and equals 1 if true.
Characteristics of enterprise and product	
firmage	Age of the firm which equals 2014 minus year of establishment
firmage2	Squared term of firm age (*firmage2=firmage*firmage*)
jsc	Dummy variable for the firm type 'Joint Stock Company', and equals 1 if true
pripro	Dummy variable for the firm type 'Private Propriety', and equals 1 if true
foe	Dummy variable for the firm type 'Affiliation of Foreign Enterprise', and equals 1 if true
*ltd**	Dummy variable for the firm type 'Limited Liability Company', and equals 1 if true
othown	Dummy variable for the firm type 'Other type of ownership than above', and equals 1 if true
*manufgrp1**	Dummy variable for manufacture of "food and beverage products", and equals 1 if true
manufgrp2	Dummy variable for manufacture of "textile, wearing apparel, leather and related products", and equals 1 if true
manufgrp3	Dummy variable for manufacture of "wood products and furniture, and paper and paper products", and equals 1 if true
manufgrp4	Dummy variable for manufacture of "chemicals and chemical products, rubber and plastic products, and non-metallic products", and equals 1 if true
manufgrp5	Dummy variable for manufacture of "basic metal, fabricated metal products, except machinery and equipment", and equals 1 if true
manufgrp6	Dummy variable for manufacture of "computers, electronic and optical products, and electrical equipment", and equals 1 if true
manufgrp7	Dummy variable for manufacture of "motor vehicles, trailers, semi-trailers and transport equipment", and equals 1 if true

Note: The asterisk (*) denotes the reference variable.

In terms of clusters/areas, the survey includes important clusters/areas of Hanoi in order to have a proper geographical coverage. Regarding the industrial sectors, 17 major subsectors of the manufacturing industries are included. The number of enterprises, which are surveyed in each of the 17 subsectors, is calculated by using the five-year average share of the respective sectors in Hanoi for 2005, 2009-2011, and 2012. In sum the SME Survey-2014 has 600 samples as the initial sample size (see Table A1 for more detail on the determination of the sample size). The fiscal year of Vietnam is 1st January to 31st December, and hence, the data from the Survey would be equivalent to calendar year data. The definition and description of variables are presented in Table 4.

Table 5: Summary statistics of the data

Variable	Obs.	Mean	Std. Dev.	Min	Max
sales2013	440	87,768	242,154	4.0	2,455,249
cap2013	440	50,180	137,103	6.0	1,192,812
currlabor	440	38	54	3.00	300.00
innovation	440	0.75	0.44	0.00	1.00
lntfp	440	2.75	1.60	-2.80	8.64
ownerage	440	46.12	9.21	19.0	76.0
maleowner	440	0.69	0.46	0.00	1.00
gradedu	440	0.07	0.26	0.00	1.00
collegeuniv	440	0.75	0.43	0.00	1.00
*vocatedu**	440	0.15	0.36	0.00	1.00
otheredu	440	0.03	0.16	0.00	1.00
*soeworker**	440	0.18	0.38	0.00	1.00
nonsoeworker	440	0.53	0.50	0.00	1.00
trader	440	0.21	0.41	0.00	1.00
famothexp	440	0.08	0.28	0.00	1.00
primtec	440	0.09	0.28	0.00	1.00
firmage	440	10.67	9.15	1.00	60.00
jsc	440	0.38	0.49	0.00	1.00
pripro	440	0.03	0.16	0.00	1.00
foe	440	0.02	0.13	0.00	1.00
*ltd**	440	0.46	0.50	0.00	1.00
othown	440	0.12	0.33	0.00	1.00
*manufgrp1**	440	0.31	0.46	0.00	1.00
manufgrp2	440	0.13	0.33	0.00	1.00
manufgrp3	440	0.16	0.37	0.00	1.00
manufgrp4	440	0.19	0.40	0.00	1.00
manufgrp5	440	0.10	0.29	0.00	1.00
manufgrp6	440	0.06	0.24	0.00	1.00
manufgrp7	440	0.05	0.22	0.00	1.00

Source: Authors compiled from survey data

Notes. 1. Monetary variables are denoted in million VND (Vietnamese Dong)

2. The asterisk (*) denotes the reference variables in the regressions.

The summary statistics of firm data and entrepreneur's human and social capital are presented in Table 5. It reveals that the average sales of SMEs in Hanoi are about VND87.8 billion[3] and the capital equipment is roughly VND50.2 billion. A representative SME would hire 38 employees in 2013 and would earn VND3.3 billion gross profit. Roughly 75% of the respondents report that they have achieved some innovation in introducing new product/process, or significantly improving the existing product/process. The average age of entrepreneur in Hanoi is 46 years. The majority of SME owners/managers have completed college or university education (75%) or graduate education, including Master's and doctoral levels (7%).

4. Results and Discussions

The impact of entrepreneur's human capital (education, experience, and level of production technology) on product innovation is estimated by using a Probit procedure, and the Ordinary Least Square (OLS) estimation is applied to evaluate the association between human capital and firm performance[4] (Table 6). All the variables are derived from one-year data (2013). Column 1 presents the result from the marginal effect of the Probit model (Equation 2). Column 4 presents the OLS result for total factor productivity (Equation 3). The absence of collinearity among the explanatory variables is confirmed by means of a correlation matrix (Table A2). In addition to human capital measures, other variables of owner and firm characteristics, such as owner's age and gender, types of enterprise (ownership structure), firm age and manufacturing subindustries are controlled for in the estimations. Due to limited number of samples the 17 subindustries are consolidated to 7 subsectors (*base group: food and beverage*).

Overall, from the innovation equation human capital variables (education, level of technology) and control variables (firm age, ownership structure, and manufacturing subindustries) appear to exert some significant impact on innovation. However, out of the same set of explanatory variables only the subindustry dummies show a significant association with firm productivity in the productivity equation. It is worth noting that Equation (3) can well be interpreted as an evaluation of firm performance or successful entrepreneurship.

[3] The average exchange rate (for 1USD) is 20,933 VND (2013) and 21,148 (2014) (ADB, Key Indicators, 2015).
[4] In empirical economic literature total factor productivity (TFP) is widely used as a proxy for 'firm performance'. On the other hand, TFP is often used to indicate 'successful entrepreneurship' in literature on entrepreneurship as well. In this study both terms ('firm performance', 'successful entrepreneurship') are used in relation to TFP.

Table 6: Human capital impact on innovation probability and TFP of SMEs in Hanoi

		Probit for innovation (marginal effect)				OLS for total factor productivity		
Variables		Coefficient	Std-err	P>|z|	Mean	Coefficient	Std-err	P>|t|
ownerage		-0.006**	0.003	0.019	46.12	-0.007	0.009	0.451
maleowner	*(*)*	-0.090*	0.048	0.061	0.691	0.058	0.183	0.753
gradedu	*(*)*	0.176***	0.044	0.000	0.070	0.221	0.331	0.505
collegeuniv	*(*)*	0.113*	0.066	0.084	0.752	0.137	0.220	0.534
otheredu	*(*)*	-0.187	0.162	0.246	0.027	0.330	0.358	0.357
nonsoeworker	*(*)*	0.011	0.066	0.870	0.525	0.309	0.226	0.173
trader	*(*)*	0.081	0.068	0.238	0.214	0.321	0.275	0.244
famothexp	*(*)*	-0.073	0.104	0.483	0.084	-0.109	0.328	0.739
primtec	*(*)*	-0.301***	0.095	0.001	0.089	-0.013	0.256	0.960
lnfirmage		0.283***	0.102	0.006	2.124	0.608	0.405	0.134
lnfirmage2		-0.043*	0.023	0.063	4.981	-0.099	0.085	0.245
jsc	*(*)*	0.100**	0.043	0.019	0.380	-0.047	0.164	0.775
pripro	*(*)*	0.140*	0.073	0.055	0.025	-0.863	0.558	0.123
foe	*(*)*	0.010	0.156	0.951	0.018	-0.893	0.572	0.119
othown	*(*)*	0.129**	0.051	0.012	0.120	-0.135	0.292	0.644
manufgrp2	*(*)*	-0.241***	0.089	0.007	0.125	0.093	0.260	0.720
manufgrp3	*(*)*	-0.175**	0.084	0.036	0.159	0.073	0.257	0.777
manufgrp4	*(*)*	-0.165**	0.080	0.040	0.193	0.966***	0.216	0.000
manufgrp5	*(*)*	-0.239**	0.104	0.022	0.095	0.610**	0.261	0.020
manufgrp6	*(*)*	-0.187	0.120	0.120	0.064	0.858***	0.308	0.006
manufgrp7	*(*)*	-0.003	0.107	0.978	0.050	0.838***	0.288	0.004
constant		-	-	-	-	1.584**	0.697	0.024
Observations		440				440		
Log-likelihood		-207.742				-		
R-squared		-				0.102		
Pseudo-R^2		0.168				-		

Notes: 1. Standard errors in parentheses (Probit), robust standard errors in parentheses (OLS).
2. *** p<0.01, ** p<0.05, * p<0.1
3. *(*) dy/dx* is for discrete change of dummy variable from 0 to 1.
4. Log-likelihood is Log-pseudo likelihood for the Probit regression.

4.1 Entrepreneur's human capital, innovation and productivity

First, human capital variables that are considered to influence entrepreneurship are divided into three categories: 'education', 'experience' and 'skill'. The survey reveals that about 82% of the SME owners who answered the questionnaires have college/university or a higher education level (post graduate, Master's, doctoral levels). This result implies a relatively high level of education among entrepreneurs in Hanoi (Table 7). The result is not surprising because the samples are from Hanoi, the capital city and one of the major economic centers of Vietnam.

Table 7: Educational background of owners

Educational background	Number	% share
Vocational education	97	16.0
College and university education	447	73.5
Graduate education	34	5.6
Other education	30	4.9
Total	*608*	*100.0*

Source: Authors' calculations based on the SME Survey 2014.
Notes: 1. The figures presented in the table are based on 608 observations, while the actual numbers of observations used for the regressions are 440. 2. Graduate education includes Master's and doctoral levels. 3. Other education includes: no or non-complete primary education; lower and upper secondary education; and no training.

The estimates for college/university and graduate education are positively significant for the innovation equation (Table 6, Column 1). This result implies that, as compared to owners with vocational education background, entrepreneurs with graduate and post-graduate education have a higher probability of achieving improvement in their product/service, and/or introducing a new product/service. In other words, high human capital tends to enhance innovative activities. This result lends support to the finding of owner's human capital being a crucial factor for innovation in recent literature on Vietnam's SMEs (Vu, 2014).

Second, the discussion on human capital addresses the effect of work experience prior to the start-up. The analysis compares work experience in 'non-state enterprises', 'being trader', or 'experience in family business and other work experiences (including farming, work in the government, being unemployed and too young to work)' to the *base group* of 'working in state-owned enterprises (SOEs)'. The coefficient estimate for work experience is insignificant and implies that having work experience in the technical area would not necessarily stimulate innovativeness and entrepreneurial performance or successful entrepreneurship. Nonetheless, it is worth noting that the positive sign of the estimates for work experience (except for family businesses) implies that having worked in trade and/or non-state enterprises would have some positive affect on the entrepreneur's attitude toward innovation and successful entrepreneurship, because she would more likely have experienced some requirement for innovativeness and/or productivity enhancement in her work someone working in the a state-owned enterprise. This result lends support to the finding on human capital and innovation relationship in recent innovation studies for Vietnam (Vu, 2014; Pham and Matsunaga, 2016). However, the analysis in this study could not capture this effect empirically.

Third, the estimate for production technology in a firm (*primtec* is defined as using primitive technology) would point to a lower probability of innovation and lower firm performance. The result is plausible in the way that the use of primitive technology in production, such as hand tools and manually operated machinery, would suggest a relatively lower level of entrepreneurial human capital which could impede innovative activities and productivity enhancement.

Fourth, with respect to age and gender of entrepreneurs, the result reveals that owners at higher age are less likely to have innovation and that male entrepreneurs appear to be less successful than their female counterparts in innovation. This result raises an interesting issue that, despite facing gender inequality problem, female entrepreneurs in Hanoi tend to be superior to their male counterparts in innovation. However, it would need further in-depth investigation to draw a persuasive conclusion on this issue.

In sum, the result lends support to a positive impact of human capital in enhancing product innovation/adaptation (Vu, 2014; Pham and Matsunaga, 2016) and successful entrepreneurship/ firm performance (Van Praag and Cramer, 2001; Vixathep and Matsunaga, 2015). A positive combination of owner's higher education (university and post-graduate levels) and a larger firm size enhancing value added and TFP was found among micro and small enterprises (MSEs) in Vietnam (Vixathep, 2013). In literature, human capital has shown positive influence on entrepreneurial performance with various degrees of impact (Bosma et al., 2004).

4.2 Firm characteristics and manufacturing subindustries

Firm characteristics considered in this study include firm age (years of operation), ownership structure (Joint Stock Company, private proprietor, affiliate of foreign enterprise, limited liability company (*base group*)), and manufacturing subindustries (see Table A1 for more detail on the industrial sectors). First, the firm age illustrates some strong positive influence on innovativeness and some positive (but statistically insignificant) impact on firm performance or successful entrepreneurship. A plausible explanation for this result is that staying in the business would help entrepreneurs accumulate knowledge and skills, which could further enhance her innovativeness and entrepreneurial performance. However, the question on innovation in the survey provides a multiple choice for interviewees to decide their answer, while the estimation of the TFP score relies on the availability and quality of the input and output data and the assumption of the production function. In the latter case the limited quality of the answers and the associated variables would have strong influence on the significance of the coefficient estimates in the productivity equation. Nonetheless, the sign of the coefficient for '*firmage*' and '*squared firmage*' in both

equations illustrates a 'diminishing marginal return' to firm experience (an inverted U-shape trend). The quality of 'diminishing marginal return' also exists in other determinants of innovation, such as R&D expenditure (Acs and Audretsch, 1988).

Second, the coefficients for types of firm ownership are somewhat mixed and suggest that owners of enterprises with joint stock, private proprietorship, foreign ownership and other ownership categories are more likely to have product/service innovation as compared to limited liability ownership. On the other hand, the association between the ownership structure and firm productivity points to the opposite direction, albeit the relationship is statistically insignificant. These results appear to be contradicting each other and would need further examination for clarification and proper interpretation.

Finally, in terms of industrial classification within the manufacturing, the coefficient estimates point to an opposite case of the ownership structure described above. Specifically, manufacturers of food and beverage *(base group)* would have a higher probability of product innovation, while they would achieve inferior productivity, as compared to enterprises in the other six subindustries under study, i.e. '*manufgrp2'* to '*manufgrp7'* (see Table 3 for definition of the industrial groups covered under the study).

It is worth noting that the results in this section (Section 4.2) are not contradicting to those in the existing literature, but at the time of writing this paper it is still not possible to find a comprehensive explanation for the results. Thus, a more detailed examination of these issues would need an in-depth study and is left for further research or for expansion of this paper. This result shows an interesting case for future research.

As the final note on the empirical results it is necessary to point out three limitations of the study. First, the analysis and discussion on innovation would have been more accurate, if the following three conditions could be applied for defining innovation: (i) Is the innovation that occurred new to the enterprise, the industry, or the country, or the world? (ii) Is the innovation-induced product/process discontinued from the existing product/process? and (iii) How influential is the effect of the innovation to the industry or to Vietnam? However, if such assumptions were applied in the questionnaire, the dummy variable for '*innovation*' in the analysis would have been zero in nearly all cases and the analysis would have been invalid. Second, the question on innovation in the questionnaire could only ask for a *Yes/No* answer and could not go into detail of innovation. Finally, the limited quality of the questionnaire might have some impact on the result of the empirical analysis. Nonetheless, if we consider the real/actual situation of the SMEs in Vietnam (as described in the last part of Section 2) and compare the innovation variable in this study with those applied in published literature, it can be stated that this study has addressed some important issues related to human capital-innovation relationship in Vietnam's

manufacturing industries, and thereby, made some significant contribution to fill the research gap on innovation for Vietnam's SME sector.

5. Conclusion

Economic reforms in Vietnam (also known as the Doi Moi policy) have transformed the economy into multi-ownership market economy with the state, non-state and foreign sectors. The relatively young private sector, with the manufacturing industries at its core, is dominated by vibrant small and medium enterprises. SMEs have played an important role in promoting the industrialization and generating employment opportunities for the workforce. With a young private sector, many of SME owners are first-generation entrepreneurs with their human capital and social capital being the two most important factors that enhance their innovativeness and successful entrepreneurship.

In view of deepening our understanding on the contribution of innovation and entrepreneurship to economic development in Vietnam, the present paper addresses the relationship between human capital (education, experience) with innovation and successful entrepreneurship (innovation, TFP) for SMEs in Hanoi as a case study. The paper applies primary data of SMEs in Hanoi collected by the authors in a questionnaire survey in 2014 and several interview surveys in various industrial centers in Hanoi and Ho Chi Minh City for the analysis and discussions. The latest field survey on innovation was conducted in Hanoi and HCMC in August 2016.

The research reveals some important findings. First, the study confirms the existence of a high level of human capital (high education levels) among entrepreneurs in the manufacturing SMEs in Vietnam and lends some support to similar findings for the Bangladesh's garment industry (Monttaleb and Sonobe, 2011; Vixathep and Matsunaga, 2015). Second, it re-confirms the positive relationship between human capital and innovativeness/successful entrepreneurship, and thereby, emphasizes the importance of education for SME-sector development and for economic development as a whole. Third, the study also confirms that the quantification of the relationship among entrepreneurship, innovative activities and the degree of successful entrepreneurship is in large measure an empirical question, for which the answers considerably depend upon the practical indicators of entrepreneurship.

Notwithstanding the limitations in information content (e.g. lack of information on material inputs) and data quality, the findings pertain to the importance of human capital, and a promotion of innovation and entrepreneurship in economic development. It gives rise to the quality and appropriateness of education and training for entrepreneurs, if the policy target of the government is to foster innovation

and successful entrepreneurship, and to promote SME development as part of socio-economic development. This issue is particularly crucial for a vibrant developing economy like Vietnam with a relative young private sector.

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Table A1: Structure of gross output of industry at current prices by industrial activity (%) and targeted sample size

Industrial sectors based on VSIC 2007	2005	2009	2010	2011	Prel.2012	Average share 2005-12 (%)	Sample size by sector	% Share (samples)
(1) Manufacture of food products	17.9	18.2	17.9	18.2	18.8	18.3	138	23.1
(2) Manufacture of beverages	2.5	2.1	1.8	1.6	1.4	1.7	15	2.6
(3) Manufacture of textiles	4.0	3.9	3.8	4.1	4.2	4.0	31	5.1
(4) Manufacture of wearing apparel	4.0	4.1	4.2	4.1	4.2	4.1	31	5.1
(5) Manufacture of leather and related products	4.3	3.2	3.4	3.4	3.3	3.3	23	3.8
(6) Manufacture of wood and of products of wood and cork	2.0	1.7	1.7	1.7	1.8	1.7	15	2.6
(7) Manufacture of furniture	3.4	3.2	3.2	2.8	2.6	2.9	23	3.8
(8) Manufacture of paper and paper products	1.9	1.8	1.9	2.0	2.1	1.9	15	2.6
(9) Manufacture of chemicals and chemical products	4.7	5.5	4.6	4.5	4.4	4.8	38	6.4
(10) Manufacture of rubber and plastics products	3.9	4.3	4.4	4.4	4.5	4.4	31	5.1
(11) Manufacture of other non-metallic mineral products	5.5	6.4	5.5	5.3	5.4	5.6	46	7.7
(12) Manufacture of basic metals	3.8	3.8	4.5	4.1	3.8	4.0	31	5.1
(13) Manufacture of fabricated metal products, excl. machinery	4.6	5.4	5.9	5.7	5.6	5.6	46	7.7
(14) Manufacture of computer, electronic and optical products	3.5	3.7	3.8	5.6	6.2	4.8	38	6.4
(15) Manufacture of electrical equipment	3.4	3.5	3.1	3.3	3.3	3.3	23	3.8
(16) Manufacture of motor vehicles; trailers and semi-trailers	2.9	2.7	2.9	2.8	2.8	2.8	23	3.8
(17) Manufacture of other transport equipment	4.5	4.4	3.8	3.8	3.8	3.9	31	5.1

Source: Statistical yearbook, 2012, General Statistics Office of Vietnam, Hanoi.
Note: Sample size by sector implies the number of enterprises to be surveyed in each respective sub-industry.

Table A2: Correlation matrix on independent variables

		x1	*x2*	*x3*	*x4*	*x5*	*x6*	*x7*	*x8*	*x9*	*x10*	*x11*	*x12*	*x13*	*x14*	*x15*	*x16*	*x17*	*x18*	*x19*	*x20*	*x21*
ownerage	*x1*	1.00																				
maleowner	*x2*	0.27	1.00																			
gradedu	*x3*	-0.11	-0.10	1.00																		
collegeuniv	*x4*	0.01	0.15	-0.48	1.00																	
otheredu	*x5*	0.00	0.08	-0.29	-0.05	1.00																
nonsoeworker	*x6*	-0.18	-0.10	0.01	0.00	-0.09	1.00															
trader	*x7*	-0.06	-0.11	0.00	-0.14	0.08	-0.55	1.00														
famothexp	*x8*	0.03	0.04	-0.09	-0.05	0.15	-0.32	-0.16	1.00													
primtec	*x9*	0.12	0.09	0.05	0.07	-0.05	0.06	-0.14	0.05	1.00												
lnfirmage	*x10*	0.42	0.17	-0.01	0.05	-0.10	-0.16	-0.05	-0.01	0.18	1.00											
lnfirmage2	*x11*	0.40	0.16	-0.01	0.05	-0.10	-0.16	-0.06	-0.01	0.22	0.96	1.00										
jsc	*x12*	-0.04	0.01	0.12	0.02	0.01	-0.01	-0.08	0.03	0.09	0.03	0.05	1.00									
pripro	*x13*	-0.09	-0.08	0.02	-0.04	-0.03	0.06	0.02	-0.05	0.00	-0.02	-0.03	-0.13	1.00								
foe	*x14*	0.10	0.09	0.04	0.03	-0.02	-0.14	-0.07	-0.04	-0.04	0.06	0.05	-0.11	-0.02	1.00							
othown	*x15*	0.18	0.13	0.00	0.03	-0.02	0.00	0.03	0.04	-0.07	0.06	0.05	-0.29	-0.06	-0.05	1.00						
manufgrp2	*x16*	-0.06	-0.01	-0.01	0.00	-0.02	0.04	-0.01	-0.07	0.00	-0.17	-0.14	-0.01	-0.06	0.00	-0.06	1.00					
manufgrp3	*x17*	0.11	0.08	-0.10	-0.07	0.19	-0.05	-0.04	0.18	0.02	-0.03	0.00	0.01	-0.03	-0.01	-0.05	-0.16	1.00				
manufgrp4	*x18*	0.03	0.09	-0.04	0.02	-0.05	0.03	-0.10	0.02	0.11	0.09	0.06	0.04	-0.04	-0.02	-0.04	-0.18	-0.21	1.00			
manufgrp5	*x19*	0.07	0.18	0.03	0.09	-0.05	-0.12	-0.04	-0.04	0.01	0.11	0.11	0.03	-0.05	0.01	0.09	-0.12	-0.14	-0.16	1.00		
manufgrp6	*X20*	0.02	0.11	0.02	0.07	-0.04	0.10	-0.02	-0.05	0.02	0.06	0.05	-0.03	0.08	-0.04	0.05	-0.10	-0.11	-0.13	-0.08	1.00	
manufgrp7	*x21*	0.10	0.09	0.04	0.02	-0.04	0.03	-0.04	0.04	0.00	0.06	0.06	0.01	-0.04	-0.03	0.11	-0.09	-0.10	-0.11	-0.07	-0.06	1.00

Note: The maximum value of the pair-wise correlation coefficient among the independent variables is 0.42, with the exception of the correlation between '*lnfirmage*' and '*lnfirmage2*' for evaluating the diminishing marginal effect of firm age.